QUALITY OF LIFE AND THE BENEFITS OF REMEDIATION IN PATIENTS WITH HEARING LOSS OR PERIPHERAL VESTIBULAR DISORDERS.

Capstone Project

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By

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ABSTRACT

This paper presents the effect that hearing loss and Benign Positional Proximal Vertigo (BPPV) have on quality of life and the impact of treatment. The primary purpose of this paper is to critically review the existing literature to determine the effect of hearing loss and BPPV as well as appropriate treatment methods. I find that both hearing loss and BPPV result in negative quality of life and the use of effective treatments can improve the patient's quality of life.

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LIST OF ABBREVIATIONS

BPPV	Benign Paroxysmal Positional Vertigo
dB	Decibel
HHIE	Hearing Handicap Inventory for the Elderly Questionnaire
SF-36	Short Form 36 Questionnaire
EuroQol	European Quality of Life Questionnaire
MMSE	Mini Mental Status Examination
IADL	Instrumental Activities of Daily Living
APVR	Aquatic Physiotherapy for Vestibular Rehabilitation
VDI	Vertigo, Dizziness, Imbalance Questionnaire
VSS	Vertigo Symptom Scale

CHAPTER 1

Introduction and Overview

Quality of life is defined as a person's perception of the effects from a disease on the ability to enjoy every day life activities (Vuorialho, Karinen, & Sorri, 2006). According to Felce and Perry (1995) quality of life can be measured by taking into account both subjective and objective indicators that include a person's physical, social, emotional, and material wellbeing as well as their ability to develop and be involved in activity. Quality of life studies have been utilized across the medical field to determine the positive and negative outcomes that are associated with different treatments. Audiological studies indicate that auditory disorders and vestibular pathologies negatively impact quality of life (Dalton et al., 2003; Patatas et al., 2009). This paper discusses the effects of hearing loss and Benign Proximal Positional Vertigo (BPPV) on quality of life as well as the benefits of treatments for both conditions.

The auditory system is a complex system that is comprised of the outer, middle, and inner ear as well as the auditory pathways to the brain (Appendix figure 1 & 2). The outer ear is made up of the pinna and external auditory meatus. These structures assist in funneling air vibrations into the middle ear, which is comprised of the tympanic membrane, malleus, incus, stapes, stapedius muscle, tensor tympani muscle, and the eustachian tube. The main purpose of the middle ear is to change air vibrations into mechanical vibration, which amplify sounds preparing them to enter the fluid filled cochlea. The inner ear houses the cochlea and the semi-circular canals. The cochlea is divided into three portions; the scala vestibuli, scala media and scala tympani. The scala vestibuli and scala tympani contain fluid called perilymph. Perilymph is high in sodium. The scala media is filled with potassium rich endolymph. The inner ear changes the mechanical sound from the middle ear to nerve impulses that will be sent through the cochlear nerve toward the central auditory pathway. This change to nerve impulses occurs when the stapes pushes into the oval window causing traveling waves to form in the perilymphatic fluid of the scala vestibuli. When the fluid is displaced the resulting wave vibrates the basilar membrane, leading to the bending of stereocilia on the top of the outer and inner hair cells that are housed within the organ of corti (Katz, 2002). The hair cells line the entire length of the cochlea and are arranged tonotopically. When the stereocilia are bent they open a gated ion channel that leads to voltage change which causes outer haircells to change in length. Expansion and contraction of outer haircells create relative motion between the tectorial membrane and basilar membrane. This motion heightens the response of the outer hair cells causing better hearing sensitivity and frequency selectivity (Katz, 2002). When the outer and inner hair cells are bent as a result of the traveling wave, they cause the cochlear nerve (cranial nerve VIII) to fire off signals, which are sent to the brain via the auditory pathway (Nolte, 2002).

The cochlea is connected to the vestibule, which houses the utricle and the saccule and is also fluid filled (Appendix figure 3). Both the utricle and the saccule have hair cells with the longest being the kinocilium and the shorter hair cells called stereocilia (Goebel, 2008). When the stereocilia are forced to move toward the kinocilium this results in an increase in the cells firing rate (Goebel, 2008). When the sterocilia are forced away from the kinocilium it results in a decrease of the cells firing rate. The increases and decreases in cells firing rates result in a functioning vestibular system's ability to detect movements in different planes (Goebel, 2008). The utricle is responsible for the detection of a person's movements when they are moving forward, backwards, or side to side (Nolte, 2002). The saccule is most noted for detecting movements that are forward, backward or up and down as well as a person tilting their head sideways (Nolte, 2002).

The vestibule is also attached to the three semicircular canals; the lateral, posterior, and superior canals, which are positioned 90 degrees to one another and contain endolymph (Goebel, 2008). Each canal has an ampulla at one end of the canal. This ampulla houses a crista, which is a ridge of tissue that is covered with sensory hair cells known as the cristae ampullaris (Goebel, 2008). The cupula is a gelatinous mass that covers the crista. Head movements cause the canals' endolymph to move which in turn results in the deflection of the cupula. The movement of the cupula then causes an excitatory or inhibitory response on the nerve-firing rate depending on the direction that it has been moved (Goebel, 2008). This results in the ability of each semicircular canal to respond best to changes in the speed of rotation in the particular plane they exist (Nolte, 2002). Each canal is matched with the canal from the other side of the vestibular system; the posterior canal of one side would be matched to the anterior canal of the other side, and the horizontal canals of each side are matched as a functional pair (Nolte, 2002). Thus, with every head movement at least two canals have a neural response to that movement (Goebel, 2008). These components of the inner ear make it possible for a normally functioning system to help a person's brain determine body movements.

When a pathology affects any part of the auditory system (outer, middle, inner, or neural) it can create auditory perception difficulties. Auditory disorders occur at various sites in the system. Tinnitus, sensorineural hearing loss, conductive hearing loss, and mixed hearing loss are examples of disorders due to pathology in one or more auditory areas. Each has been found to negatively impact the quality of life in people who have the disorders (Dalton et al., 2003). Even a mild sensorineural hearing loss, 25dB-40dB air and bone conduction thresholds, in older adults can lead to a person having a decreased quality of life (Dalton et al., 2003). A mixed hearing loss, consisting of both a conductive and sensorineural component, can have all the same impacts as sensorineural hearing loss.

Studies have also shown that both central and peripheral vestibular disorders can result in poor quality of life (Gamiz & Lopez-Escamez, 2004; Gans & Crandell, 2000; Lopez-Escamez, Gamiz, Fernadez-Perez, & Gomez-Finana, 2005). Meniers disease, vestibular neuritis, Benign Proximal Positional Vertigo (BPPV) are a few disorders that can be entirely debilitating when left untreated. Having a central or peripheral vestibular loss can cause a person to have difficulty at work and withdraw from social settings because they are unable to move about the world 'normally' for fear an attack might occur in a public place. Vestibular disorders can also result in falls that cause broken bones.

Nearly every pathology in the medical realm has some form of treatment. It has been the job of researches and clinicians to determine which treatments are truly effective. A treatment's effectiveness depends upon a variety of measurements and outcomes. Quality of life is a major concern for professionals treating patients who suffer from sensorineural hearing loss and/or BPPV. It is important to measure the impacts of a disorder on a person's quality of life to determine the efficacy of treatments for a diagnosed disorder. Sensorineural hearing loss is most often treated by having the patient utilize hearing aids; while BPPV is treated using varying repositioning maneuvers and exercises. The purpose of this paper is to review previous research and assess the quality of life in older adults with hearing loss and the benefits of amplification along with quality of life in older patients with the peripheral vestibular disorder BPPV and the benefits of therapy.

CHAPTER 2

Hearing Loss

Hearing loss can be broken down into five different types: conductive, sensorineural, mixed, functional, and central. Conductive hearing loss is a result of a pathology affecting the outer and or middle ear. Some conductive patholgies include cerumen occlusion, otitis media, ossicular disarticulation, atresia, otitis externa, and otosclerosis. Conductive losses attenuate the intensity of incoming sound and cause the afflicted person to hear sounds as being more dampened but clear. Conductive hearing losses are often medically correctable or can be very successful treated with consistent use of hearing aids (Musiek & Baran, 2007). Sensorineural hearing loss is caused by damage or deformity of the inner ear or VIIIth nerve. This damage can be a result of congenital birth defects, heredity, noise exposure, presbycusis, VIIIth nerve tumors, ototoxic drugs, and head trauma. Presbycusis is defined as an age related hearing loss that occurs slowly as a person ages and most commonly results in a high frequency sensorineural hearing loss (Katz, 2002). Sensorineural hearing loss causes the affected person to hear sounds as being more loss of sensitivity and often distorted. Sensorineural hearing loss is not currently medically correctable. A mixed hearing loss is a combination of a conductive hearing loss and a sensorineural hearing loss. This can be caused by a pathology of the outer or middle ear and the inner ear or VIIIth nerve.

Functional hearing loss is a hearing loss that is greater than what can be explained by the pathology of the auditory system. Functional hearing loss can be a result of someone who is malingering or has psychogenic motivations. This kind of hearing loss can be discovered using and comparing several different audiologic procedures. Central hearing loss is defined audiologically as a person who has normal hearing, able to recognize that sounds are presented, but are unable to understand in more challenging listening environments. This is caused by pathologies within the central nervous system.

Hearing loss is the third most commonly reported chronic problem reported to health care providers amongst the older population (Wiley et al., 2000). The most common form of hearing loss in older populations is sensorineural hearing loss. Sensorineural hearing loss can range from a mild loss between 20dB and 40dB to a profound hearing loss which is indicated by a loss of 91dB or greater. Sensorineural hearing loss is diagnosed by completing audiometric testing including air conduction, bone conduction, immittance testing, speech recognition thresholds, otoacoustic emissions, auditory brainstem response, and word recognition scores. A person is diagnosed with a sensorineural hearing loss when both their bone and air conduction thresholds are greater than 20dB. Results for otoacoustic emissions and auditory brainstem response differ depending on the degree of sensorineural hearing loss. For a sensorineural hearing loss to be purely sensorineural the air and bone conduction thresholds must be within 10dB of one another. A difference greater than 10dB indicates a conductive component in the hearing loss. Presbycusis, hearing loss caused by age, is broken down by Schuknecht (1993) into several hypothesized causes; sensory, metabolic, neural, cochlear conductive, indeterminate, and mixed presbycusis. The benefits a person may achieve from amplification may vary according to the cause. Sensory presbycusis is noted by a high frequency loss caused by damage to the outer hair cells (Schuknecht, 1993). Neural presbycusis is characterized by a loss that slopes slightly with poor word recognition scores (Schuknecht, 1993). Neural presbycusis is caused by damage to neurons (Schuknecht, 1993). Metabolic presbycusis is a slightly sloping hearing loss with good word recognition scores (Schuknecht, 1993). It is believed to be a result of a lack of blood flow to the stria vascularis. Cochlear conductive presbycusis is characterized by a gradual sloping loss, it is hypothesized that it is a result of atrophy of the basilar membrane (Schuknecht, 1993). Indeterminate presbycusis is a hearing loss consistent with a sensory loss and thought to possibly be a loss of hair cell function. Mixed presbycusis is the combination of two or more of the forms of presbycusis (Schuknecht, 1993). Attempting to differentiate among these forms of presbycusis is currently speculation, in most cases, as the pathologies cannot be determined until an autopsy is completed. Thus a clinical audiologist utilizes these different forms of presbycusis only as guidelines in treating their patients.

Many different questionnaires have been developed and tested to determine the effects hearing loss has on a person's quality of life. Years of research have been dedicated to finding the appropriate tools to measure the effects of hearing loss. As discussed by Barton, Bankart, and Davis (2005) a person's score on one questionnaire does not necessarily reflect how the same person will score on a different questionnaire. In this study the researchers compared the level of agreement of the EuroQol, Health Utilities Index Mark III, and the Short Form 6D to determine the quality of life in patients before and after they were first fit with hearing aids (Barton, Bankart, & Davis, 2005).

The purpose of the study was to determine if having a high score on one questionnaire would result in similar findings on a patient's quality of life when compared to a different questionnaire. Barton, Bankart, and Davis (2005) discovered that a patient's high score on one questionnaire did not translate to a high score on a different questionnaire. This article demonstrated the importance of knowing what the questionnaires being used to determine a person's quality of life are actually assessing. Vuorialho, Karinen, and Sorris (2006) conducted similar research comparing scores between the Hearing Handicap Inventory for the Elderly and the EuroQol questionnaire. Vuorialho et al. (2006) administered each questionnaire on first time hearing aid wearers before and after they were initially fit with hearing aids and six months after being fit with hearing aids. Initially patients without hearing aids and a hearing loss scored an average score of 28.7 on the HHIE-S and after 6 months of wearing hearing aids they scored an average score of 12.7, which indicated that hearing aids were beneficial. However, scores on the EuroQol questionnaire reported in the research were not statistically significant using the Wilcoxon Signed Ranks Test. This test rank orders the positive and negative treatment differences, sums them, and compares the smaller of the two to a critical value at a significance level of $\alpha = .01$ or .05. The result is considered significant if the sum of signed ranks is smaller than the critical value given by the Wilcoxon table (Wilcoxon, 1945). This result implies that the difference in treatment and control groups are due to sampling error rather than due to meaningful differences between control groups. These findings suggest that the EuroQol may not be an appropriate measure when assessing benefits of hearing aids. Thus both Barton et al. (2005) and Vuorialho et al. (2006) indicate that to truly assess quality of life before and after hearing aids the researcher must be sure they are using a questionnaire that will appropriately measure the effects of hearing loss on quality of life. Chia, Wang, Rochtchina, Cumming, Newall, and Mitchell (2007) researched 2431 people in a longitudinal study to determine if a person's quality of life could be measured using a generic 36-item Short Form Health Survey. The results of this experiment indicated that there was little improvement in quality of life for a person with hearing loss after being fit with hearing aids. This research does not suggest that hearing aids are not beneficial to improving quality of life, but rather that more specific questionnaires should be utilized when attempting to determine the effects. Metselaar, Maat, Krijnen, Verschuure, Dreschler, and Feenstra (2009) had findings similar to Chia et al. (2007). Metselaar et al. (2009) found that, after fitting people with hearing aids, their perceived hearing handicap was much improved, but the use of generic health related questionnaires do not show the benefits patients receive from hearing aids. This research also indicates that it is important to choose an appropriate questionnaire. A questionnaire that is more specific should be used to accurately determine outcomes.

Sensorineural hearing loss affects people differently and even a mild hearing loss can negatively impact a person's life. A person with a mild hearing loss may not notice that the hearing loss causes any sort of negative effect in their life, while another person with the same degree of hearing loss may be greatly affected in their daily life. A person's daily activities may influence how a hearing loss affects them. Souza and Hoyer (1996) claim that someone who is active; going to work, involved in social events, or around people may notice the effects of a hearing loss more than a person who keeps to his or her self. It has been discussed that untreated hearing loss can cause a hearing-impaired person to have a decline in their quality of life. Not being able to hear what other people are saying can lead a person with hearing loss to become withdrawn from their social settings due to embarrassment. According to Arlinger (2003) and Heine and Browning (2002) this withdrawal can cause anxiety, depression, loneliness, feelings of anger, disappointment, and embarrassment. Humes (1996) found that as people age they have more difficulty understanding speech in noisier settings. With hearing loss, it may be nearly impossible for elderly people to follow a conversation in a moderately noisy or busy area, leading individuals to isolate themselves to avoid these less than optimal hearing situations, further reducing their quality of life. Dalton, Cruickshanks, Klein, Klein, Wiley, and Nondahl (2003) conducted a longitudinal study to test the hypothesis that there is a negative impact of hearing loss on the quality of life in older adults and that hearing aids improve their quality of life. In their studies it was discovered that patients with greater severity of hearing loss have much worse self-reported communication difficulty, as well as are more likely to have impaired activity of daily living scores. The Dalton et al. (2003) study concludes that the severity of hearing loss in older adults is associated with negative impacts on their quality of life. Chia et al. (2007) indicated that people with bilateral hearing loss scored lower on all sections of the Short Form 36 question questionnaire (SF-36) than people with unilateral hearing loss or normal hearing, and there was not a statistically significant difference between people with unilateral hearing loss and those with normal hearing on the SF-36. These results also concluded that people with mild hearing loss had slightly lower SF-36 scores than those without hearing loss but it was not statistically significant. Chia et al. (2007) reveal that the degree of hearing loss, as well as its bilateral or unilateral nature, can change the perceived impact on their quality of life.

Dalton et al. (2003) discuss that hearing loss may not only affect quality of life but it may also negatively impact significant others. The negative impact on a significant other's quality of life could be a result of having to constantly repeat themselves, dealing with overly loud televisions, and even missing social events because their hard of hearing spouse is no longer interested in attending. As with any changes in a relationship it can cause strain and negative feelings. According to Donaldson, Worrall, and Hickson (2004) hearing loss in an older retired couple that can cause additional strain on their marriage. Having increased time with one another leading to increased communication difficulties causes this marital strain. Donaldson et al. (2004) indicated that spouses could be a leading cause for people with hearing loss to seek assistance from an audiologist. The hearing-impaired person does not notice the problems that are caused by their hearing loss while the spouse notices increasing barriers of communication with the hearing-impaired partner. Stark and Hickson (2004) investigated these assumptions further by conducting a study with 98 hearing-impaired individuals and 78 significant others. Questionnaires were used before and after the hearing-impaired patients were fit with hearing aids. Stark and Hickson (2004) concluded that hearing loss has a negative impact on not only the hearing-impaired people's quality of life but their significant other's quality of life as well. Their research also indicated that the use of hearing aids improved the hearing-impaired person's quality of life as well as that of their significant other. Yorgason, Piercy, and Piercy (2006) researched a much smaller sample that included 8 married couples and dealt with the effects of hearing loss. The couples were given questionnaires separately and questioned together. The results of their study concluded that significant others may change their daily activities to accommodate their hard of hearing partner. These accommodations might include avoiding larger gathering due to their hearing-impaired partner being unable to hear, or not going out to dinner to avoid crowded situations. These adjustments made to communicate with their hard of hearing partner can lead to a decrease in quality of life. Wallhagen, Strawbridge, Shema, and Kaplan (2004) also conducted research to determine the impact of hearing loss on a spouse's quality of life. Findings from their research indicate that people with hearing losses' significant others have poorer social, physical, and psychosocial wellbeing. Wallhagen et al. (2004) also found that spouses of males with hearing loss had significantly lower quality of lives than spouses of females with hearing loss. According to Wallhagen et al. (2004) some couples even went as far as to label hearing loss as the cause of divorce. Scarinci, Worral, and Hickson (2008) completed research on ten partners of people who had a known hearing loss. Their study was a qualitative study, interviewing the small sample using open-ended questions during one interview session. Scarinci et al. (2008) highlighted the fact that several of the participants noted that it was easier to cope with their spouses' hearing loss when their spouse had openly accepted the fact that they had a hearing loss. The partners indicated that there were several situations that greatly affected their daily life. These included their enjoyment of watching T.V. with their spouse, indicating that it was turned up too loud for them; their ability to enjoy small talk with their partner, stating that it was frustrating to repeat themselves and much easier to just not say anything at all; embarrassment for their spouse due to their communication problems; and their inability to enjoy larger parties of people. Although this study cannot be translated to the larger population of people with a hearing-impaired spouse, it does indicate that they also suffer with decreased life satisfaction. Anderson and Noble (2005) also studied how hearing loss impacts a couple's relationship status where at least one spouse has a hearing loss. The authors reported that couples had happier relationships when the hearing-impaired person in the relationship ranked their hearing loss as more severe than their significant other did. Couples were found to be less satisfied when a significant other rated the hearing-impaired person's hearing loss as more severe than the hearing-impaired person rated their hearing loss. This finding indicates that couples that are aware of their hearing loss and accept the impairment it causes are able to live more satisfied lives together. Happier relationships were also related to the person with hearing loss recognizing their hearing loss and taking responsibility for employing different approaches to communication (Anderson & Noble, 2005). Preminger and Meeks (2010) took a further look into personality characteristics of people with hearing loss and their spouses to determine the effects that those characteristics have on their quality of life. Preminger and Meeks (2010) found that hearing loss can cause increased negativity as well as a decrease in quality of life. Results from both Anderson and Noble (2005) and Scarinci et al. (2008) revealed that the more a person acknowledged their hearing loss the more likely that they and their spouse had a happier relationship. Preminger and Meeks (2010) research differed, reporting that couples who had differing levels of acknowledgement of hearing loss were more likely to have an overall decreased quality of life, thus resulting in a more negative affect on their marriage. These findings reveal that further research is needed to fully understand the effects that hearing loss has on couples. Preminger and Meeks (2010) concluded this article by suggesting that clinicians should use both the patient's and family's mood as an indicator on how willing they are to attempt treatment as well as accept a treatment that is suggested.

Most research indicates that hearing loss leads to a decrease in quality of life, thus it is essential to treat hearing loss in a manner that will restore or improve a patient's quality of life. The most common form of treatment for sensorineural hearing loss is the use of amplification or hearing aids. A wide range of technology is available in today's hearing aid market. This includes hearing aids that range from several hundred dollars a pair, to several thousand dollars a pair. Due to the high cost of hearing aids in today's market it is important for patients to be aware of the benefits that this technology can have for their every day life. For this reason research has been conducted to determine the quality of life benefits that hearing aids have for different people. One hundred ninety-four elderly veterans with hearing impairment were randomly selected to be in the experimental group and get a hearing aid (95) or be placed in the control group on a waiting list to receive hearing aids (99) in a study conducted by Mulrow, Aguilar, Endoicotte, Tuley, Velez, Charlip, Rhodes, Hill, and Dinino (1990). Each of the participants took generic quality of life questionnaires in the beginning of the experiment, after six weeks, and after four months (Mulrow et al., 1990). After tabulating the baseline questionnaires it was found that 82% of all the participants had a decrease in quality of life due to their hearing loss, and 24% of the participants were depressed (Mulrow et al., 1990). After only six weeks the experimental group who had hearing aids had improved social and emotional scores from the HHIE and improved communication function on the Denver Scale of Communication Function (Mulrow et al., 1990). Mulrow et al. (1990) also noted reduced depression in the experimental group fit with hearing aids. It was noted that no changes occurred for the control group that were on the waiting list for hearing aids. Mulrow et al. (1990) found that after four months the improvements for the hearing aid group remained while the control group's scores did not improve. Mulrow et al.'s (1990) study indicates that hearing aids improve social, emotional, and communication function as early as six weeks after being fit with hearing aids. The Mulrow et al. (1990) study is an older study and 98% of the participants in the experimental group were fit monaurally. This leaves more questions regarding the benefits of monaural versus binaural amplification as well as the possibility that there is an impact in social, emotional, and communication even before six weeks. Taylor (1993) conducted a similar longitudinal study to determine sustainable benefits of amplification on new hearing aid users where the HHIE was administered at three weeks, three months, six months, and one year post fitting. Taylor (1993) results revealed that HHIE scores improved after only three weeks of wearing hearing aids and continued to improve after three months. HHIE scores stabilized after 6 months and remained the same after one year in the Taylor (1993) study. These results are similar to those of Mulrow et al. (1990), indicating that hearing aids benefit users, though this study reveals that perceived benefit can occur sooner than was first recorded by Mulrow et al. (1990) and with continued use of hearing aids can be sustained. Vuorialho et al. (2006) research comparing quality of life measurements before and after hearing aid fittings utilizing the HHIE-S also indicated that hearing aid significantly improved the person's quality of life. Contrasting these results Chia et al. (2007) found that only a slight difference in SF-36 scores was noted for patients who had hearing loss and used hearing aids and patients who had hearing loss and did not use any form of hearing assistance. Though patients with hearing aids had a slightly higher score it was not statistically significant. These findings may indicate that hearing aids do not improve patient's quality of life or it may be an indicator that questionnaires more specific to quality of life with regard to hearing loss should be utilized instead of more generic forms.

Technology continually changes in hearing aids as well as the methods that different audiologists use to fit these technologies. Jerram and Purdy (2001) conducted research to determine the influence of technology as well as expectations and attitudes of subjects with hearing aids on the how well they accepted hearing aids. The study found that subjects were more likely to wear their hearing aids longer if they had high expectations for their hearing aids and were able to accept their hearing loss (Jerram & Purdy, 2001). Jerram and Purdy (2001) also concluded that more advanced technologies such as Wide Dynamic Range Compression (WDRC) and multiple memories also resulted in more hearing aid user satisfaction. Jerram and Purdy's (2001) study indicates that newer technology are more beneficial than previous linear hearing aids, it is important as technology continues to advance that research is conducted to ensure that the new technologies continue to improve hearing aid users quality of life. Metselaar et al. (2009) conducted research to determine the benefits of hearing aids in 254 men and women. This study also looked at the difference between two hearing aid fitting procedures, both using linear hearing aids, and the benefits patient's perceived. One fitting was to optimize speech intelligibility; while the other was a specific fitting formula. It was found that both fitting groups received benefits from the use of hearing aids, Metselaar et al. (2009) indicated that it wasn't the fitting formulas used but more likely the actual compliance of wearing hearing aids consistently that benefited the patients. Metselaar et al. (2009) was unable to determine if one fitting was more beneficial than the other. Although Metselaar et al. (2009) used analog technology in their study and currently most hearing aids are digital; this study does indicate that through consistent use of hearing aids a person can have an improvement in their quality of life.

As discussed previously Stark and Hickson (2004) found an decrease quality of life in patients who had hearing loss and spouses but improved with hearing aids. This finding suggests that hearing aids not only benefit the hearing-impaired person but also their family and friends. Scarinci et al. (2008) indicated that most of the partners interviewed found it easier to communicate with their hearing-impaired spouse when the spouse was wearing hearing aids. This denotes the benefits that hearing aids have for both the partner and hearing-impaired spouse. Jerger, Chmiel, Florin, Pirozzolo, and Wilson (1996) compared the use of hearing aids with assistive listening devices, hearing aids only, assistive listening devices only, and no amplification with one another in a group of 180 hearing-impaired elderly. Their results indicated that the use of hearing aids, assistive listening devices, or both resulted in significantly improved self-perceived handicap and speech understanding when compared with no amplification (Jerger et al., 1996). The authors indicated that although subjects reported that they liked the sound quality of assistive listening devices better, 97.3% of the subjects reported that they would rather use a hearing aid for everyday listening. The research of Jerger et al. (1996) is in agreement with other research in that hearing aids and assistive listening devices improve people's quality of life. These studies indicate that if a person with hearing impairment consistently utilizes a hearing aid or assistive listening device they are likely to have an overall improvement in their quality of life as will their close family. The key component to ensuring an increase in quality of life appears to be compliance in accepting treatment.

To influence a hearing aid user to become more compliant in utilizing their hearing aids, audiological rehabilitation in conjunction with hearing aids may benefit patients with hearing loss. Backenroth and Ahlner (2000) conducted sessions of rehabilitation where medical, psychological, educational, social and technical topics of hearing loss were discussed with 30 subjects with moderate to severe hearing loss who regularly utilized hearing aids. Through the use of qualitative data from interviews conducted with each subject the authors found that the rehabilitation program improved communication strategies (utilizing body language, lip-reading, and hearing aids to form a complete picture of what was being communicated) and increased the subjects quality of life. Backenroth and Ahlner (2000) also indicated that those subjects who acknowledged their hearing loss, so that they would then be able to address the problems that occurred as a result of their hearing loss, achieved the most success. Chisolm, Abrams, and McArdle (2004) conducted a study to determine both the short and long term effects of an audiological rehabilitation program. Chisolm et al. (2004) fit one hundred six veterans binaurally with hearing aids and randomly assigned half to a four-week audiological rehabilitation program, and the other half to only receive the hearing aids. It was found that audiological rehabilitation improved the benefits received after only six months compared to the control group (Chisolm et al., 2004). Over the course of a year it was determined that the control group and audiologic rehabilitation group had similar results. This study indicates that through the use of audiologic rehabilitation a hearing aid user can have faster initial results than someone who just receives hearing aids, but the ending result will be the same or similar. This study indicates that the faster results with the use of rehabilitation can help people who are purchasing hearing aids have a better idea within their 30 day trial period if having a hearing aid benefits them (Chisolm et al., 2004). Preminger (2003) explored the benefits of having significant others accompany hearing-impaired individuals to audiologic rehabilitation classes. This study used thirteen subjects who were accompanied by their significant others and twelve subjects who came alone to six 90-minute rehabilitation classes (Preminger, 2003). Results indicated that there was a significant decrease in the hearing handicap for all subjects who participated, while the greatest decrease was noted for those who attended class with their significant others (Preminger, 2003). These results reveal that for the greatest benefit from audiologic rehabilitation significant others should be encouraged to participate along with people with hearing loss.

Hearing loss in the aging population has become one of the most commonly reported chronic conditions. Untreated hearing loss results in a decreased quality of life in not only the person with the hearing loss but also in their significant others. The severity of a person's hearing loss is not always a good indicator of the effects that it has on their quality of life. It is important for clinicians to access the impact hearing loss has in the quality of life for both the patient and their family. These findings can assist an audiologist in selecting the appropriate treatment method for each patient. Consistent use of hearing aids, listening devices, and/or aural rehabilitation have been shown to improve the quality of life in the person with hearing loss and their significant others.

CHAPTER 3

Benign Paroxysmal Positional Vertigo

Benign Paroxysmal Positional Vertigo (BPPV) is thought to be the most common causes of vertigo in adults (Froehling et al., 1991; Schuknecht, 1969). Benign Paroxysmal Positional Vertigo is distinguished by short periods of vertigo that are caused by various movements of a person's head (Herdman, 2007). Benign Paroxysmal Positional Vertigo can cause episodes of dizziness when a person lies down, turns their head quickly, bends over, or changes position when lying down (Herdman, 2007). Benign Paroxysmal Positional Vertigo is not associated with a hearing loss or aural fullness. Herdman (2007) discusses that BPPV's most common occurrence is spontaneous, while head injuries, labyrinthitis, or ischemia in the anterior vestibular artery may also account for the occurrence. Research on BPPV has demonstrated two known pathologies that are believed to cause BPPV. The first was discovered by Schuknecht (1969), which was described as pieces of oticonia in the posterior canal, attaching to the cupula. This was named cupulolithiasis, symptoms include immediate onset of vertigo when the patient moves in a way that stimulates the posterior canal cupula, nystagmus, and continued vertigo and nystagmus as long as the person's head remains in that position (Herdman, 2007; Schuknect, 1969; Hall et al., 1979). Hall, Ruby, and McClure (1979) discussed a second form of BPPV, canalithiasis, where instead of oticonia attaching to the cupula and causing dizziness, oticonia was floating freely in the endolymph of the semi circular canals. When a person who has these freely floating oticonia moves their head it results in the displacement of endolymph which causes the cupula to change it's speed, which in turn results in a change of the firing rate in neurons. Because of this change in firing rate nystagmus occurs, but will stop eventually as the person's head remains in the same position and the oticonia settle (Hall et al., 1979; Herdman, 2007). Hall et al. (1979) discuss that canalithiasis is noted for the delay in the onset of the patient's vertigo, the occurrence of delayed nystagmus correlating with the delayed onset of vertigo, and changes in the intensity of both the vertigo and nystagmus eventually disappearing. More than one canal can be affected at the same time in the case of canalithiasis. Herdman (2007) and Goebel (2008) note that cupulolithiasis is less common than canalithiaiasis and accounts for less than 5% of the population diagnosed with BPPV. It has been found that older adults with BPPV have their symptoms significantly longer before diagnosis than younger patients (Lawson & Bamiou, 2005). This delay in diagnosis may be a result of older patients having more than one type of dizziness, which causes them to be referred to other specializations before being diagnosed.

Goebel (2008) discuses that though it is possible for all three semi-circular canals to be affected with BPPV, the posterior canal is affected approximately 90% of the time BPPV is diagnosed. Goebel (2008) continues, stating that the horizontal canal is affected around 8% of the time, while the superior canal is rarely affected. Identification of the canal which the BPPV affects can be determined by observing the patients nystagmus during the Dix-Hallpike procedure.

Table 1.1: Effects of BPPV:

Canal	Right Hallpike-Dix Test	Reversal Phase	Return to Sitting
Right Posterior Canal	Upbeating and rightward torsional	Downbeating and leftward torsional	Downbeating and leftward torsional
Right anterior	Downbeating and rightward torsional	Upbeating and Leftward torsional	Upbeating and leftward torsional
Left anterior	Downbeating and leftward torsional	Upbeating and rightward torsional	Upbeating and rightward torsional

Table 17-4 titled "Identification of Canal Involvement based on Direction of Nystagmus During right Hallpike-Dix test "from Herdman (2007) describes the resulting nystagmus.

The Dix-Hallpike maneuver is used most often to determine if a patient has BPPV in the posterior canal. Although BPPV was first mentioned by Barany in 1921, Dix and Hallpike were the first to discuss a maneuver to identify BPPV in 1952 (Dix & Hallpike, 1952). The maneuver that was used at that time is still used in today's clinics. The Dix-Hallpike maneuver is completed by first positioning the patient so they are sitting up on an examination table. The examiner takes the patient's head in their hands and quickly turns the patients head towards the examiner until the patient's head is approximately 30 degrees from the starting position. The examiner then takes the patient's head and quickly lies the patient down on the table allowing the patient's head to hang off the end at about 30 degrees while being held in the examiner's hands for support (Goebel, 2008; Dix & Hallpike, 1952). This position is held for 30 seconds, the whole time the patient's eyes should be wide open and focused on the examiner so that the examiner can observe eye movements for the presence of nystagmus. After 30 seconds with the patient's head hanging over the table, the examiner returns the patient to the original position. It is essential that the examiner continually monitor the patient's eyes for any nystagmus that may occur. If there are signs of nystagmus at any point during the Dix-Hallpike maneuver, table 17.4 from Herdman (2007) can be used to assist in identifying the canal that is affected. If nystagmus is present after the Dix-Hallpike maneuver is completed it is considered to be a positive response, while if there is no nystagmus it is considered to be a negative response. If BPPV appears to be present, the Dix-Hallpike maneuver should be completed a second time to determine if the response has been fatigued as this is a characteristic of a peripheral pathology (Goebel, 2008; Dix & Hallpike, 1952). Hoffman, Einstadter, and Kroenke (1999) reviewed the current literature on the effectiveness of the Dix-Hallpike maneuver and found that the sensitivity of the maneuver ranged from 50% to 88% across the literature. This indicates that the maneuver may be more or less sensitive to identifying BPPV depending on the clinician who is administering the maneuver. For this reason, repeating the Dix-Hallpike maneuver may help to ensure that the results are accurate.

The Side-Lying Test is another maneuver that can be used to determine the presence of BPPV in the posterior canal if the patient has neck problems or is obese and is unable to have the Dix-Hallpike performed on them (Goebel, 2008; Lawson & Bamiou, 2005). Goebel (2008) describes this procedure as the patient being seated in an upright position with their legs hanging from the end of the examination table. The patient's head is rotated forty-five degrees away from the labyrinth that is suspected to contain oticonia. The patient is to quickly lay down in the direction opposite of the direction they are facing. While the patient is lying on their side their eyes are monitored for torsional nystagmus (Lawson & Bamiou, 2005). After a minute the patient is returned to a seated position with their head still turned forty-five degrees, and their eyes are once again monitored for nystagmus. The patient's head is then moved forty-five degrees in the other direction and the procedure is completed on the opposite side, all the time checking the patient's eyes for nystagmus (Goebel, 2008). According to Salvinelli, Casale, Trivelli, Ascanio, Firisi, Lamanna, Greco, and Costantino (2003) Sermont's liberatory maneuver is completed in the same way that the side-lying test is administered. Table 17.4 from Herdman (2007) can be used to assist in identifying the canal that is affected when using the Sermont's Liberatory Maneuver/side lying test.

The roll test is used to determine if the horizontal canals are affected by free-floating oticonia (Lawson & Bamiou, 2005). This test is used much less often than the Dix-Hallpike maneuver or side lying test as the horizontal canals account for only around 8% of BPPV cases (Goebel, 2008). To administer this test, the patient lies in supine position with their head flexed at about 20 or 30 degrees. The patient's head is quickly moved to one side and then slowly moved back to starting position. This is repeated moving the patient's head to the opposite side and then slowly back to starting position again (Lawson & Bamiou, 2005). The patient's eyes are monitored for nystagmus throughout this procedure.

The first step in treating BPPV is to determine if it is caused by canalthiasis or cupulolithiasis to determine what treatment would be most appropriate. Additionally, it must be known which canal(s) is/are affected. There are several different methods of treatment that can be used for BPPV caused by canalithiasis. The treatment used depends on the canal that is affected. Canalith Repositioning, Brandt-Daroff habituation exercises, Sermont's Liberatory maneuver, and the Epley's repositioning maneuver will be discussed.

Questionnaires are often used to determine the affects BPPV has on patients. Determining which questionnaires truly measure the affects of the BPPV on quality of life has been studied by several authors. Gans and Crandell (2000) researched a small group of patients that had been diagnosed with BPPV. Each patient completed the Short Form 36 Health Questionnaire before and after treatment. Their article revealed that lower SF-36 scores were related to greater functional impairment. Gans and Crandell (2000) found significantly higher scores in SF-36 questionnaires after canalith repositioning had been completed. These results indicated that the SF-36 is an appropriate tool to measure the effects that BPPV has on a patient's quality of life. Similar results were found in Gamiz et al.'s (2004) study, where there was a significant improvement on the SF-36 after canalith repositioning was completed.

Research on BPPV has been conducted to determine if having BPPV changes the quality of life outcomes on patients compared to people who do not have BPPV. Gamiz and Lopez-Escamez (2004) conducted a study on thirty-two patients with BPPV who were over the age of sixty to determine if BPPV caused a decrease in quality of life. This study used the Medical Outcomes Study 36-Item Short Form Health Survey and the Dizziness Handicap Inventory Short Form before and after particle repositioning maneuver treatment of BPPV. The responses for each questionnaire were compared with the norms for adults to determine if there was a significant difference. After analysis of the data Gamiz and Lopez-Escamez (2004) discovered that there was a significantly negative impact on health-related quality of life for patients who had BPPV.

It was also discovered that after being treated by Particle Repositioning Maneuver the quality of life scores significantly increased indicating that treatment was effective. Oghalai, Manolidis, Barth, Stewart and Jenkins (2000) also conducted a study on one hundred geriatric patients to determine the prevalence of undiagnosed BPPV and the effects of that BPPV. It was found that 9% of the subjects had BPPV and their Activities of Daily Living (ADL) score when compared to those who did not have BPPV were significantly lower. Oghalai et al. (2000) also found that patients who had undiagnosed BPPV had a higher prevalence of falls than those who did not have BPPV. It was also discovered that patients with BPPV were more likely to have been diagnosed by their primary care physician with depression than those who did not have BPPV. Instrumental Activities of Daily Living (IADL) and Mini Mental Status Examination (MMSE) were shown to be statistically significant between the two groups (Oghalai et al., 2000). These results suggest that those who have BPPV are more likely to need assistance from others and are at a higher risk for fall than those who do not have BPPV. Oghalai et al. (2000) attributed patients with BPPV's higher depression rates after a fall to the patient's greater fear of falling, which reduced their ability to participate in normal activities, resulting in isolation, thus causing depression. Magliulo, Bertin, Ruggieri, and Gagliardi (2005) discussed the effects of BPPV on quality of life after the symptoms had been cured. In Magliulo et al.'s (2005) study the authors followed patients with BPPV after successful repositioning maneuvers to determine the effects on their psychological and psychosocial aspects of life. In this study it was found that 27% of the patients from their sample had residual negative influences on their quality of daily life (Magliulo et al., 2005). They suggested that although there was an absence of nystagmus the patients still reported dizziness and balance issues. This research suggests that even after successful treatment of BPPV some patients still experience a reduced quality of life due to residual effects of the disorder in the psychological realm. Magliulo et al. (2005) discuss this finding as an implication for appropriate counseling as well as the possible need for further referral for psychological help.   Seok, Lee, Hoon Yoo, and Lee (2008) indicated that 61% of patients they treated for BPPV had residual dizziness after successful repositioning procedures. Seok et al. (2008) reported that the residual dizziness lasted on average ten days and was completely gone in all patients after three months. The authors went on to explain that residual dizziness may be caused by remaining oticonia debris that were not repositioned and not dense enough to cause nystagmus when freely floating, the disorder of the otoliths causing dizziness, the cause of a different vestibular lesion that may "coexist" with BPPV, or the need for the central nervous system to adapt once again after the particles have been repositioned (Seok et al., 2008). These causes or others not yet discovered may result in the continued negative effects on quality of life that were reported by Magliulo et al. (2005). Seok et al. (2008) found that the longer a person suffered from BPPV the more likely it was that they would have residual dizziness. This indicates that the sooner BPPV can be treated the less residual dizziness a person may have, which will help to improve their quality of life faster.

Studies have been completed on patients who have Benign Positional Proximal Vertigo to indicate effective ways of treating BPPV and it's reoccurrences. Lopez-Escamez, Gamiz, Fernadez-Perez, and Gomez-Finana (2005) completed research to determine the long-term effects on patients with BPPV's quality of life after being treated with particle repositioning. The SF-36 and Dizziness Handicap Inventory Short form were completed before treatment, 30 days, 180 days, and 360 days post treatment. The Dix-Hallpike maneuver was also completed at each of these times. This differs from previous studies as the maneuver was used to identify BPPV, but not used after the BPPV was treated. The result of Lopez-Escamez et al. (2005) study indicated that 88% of patients treated with particle repositioning had a negative Dix-Hallpike one year after treatment. The scores on the questionnaires indicated that their quality of life post treatment was significantly improved. These results are very similar to the findings of Dorigueto, Mazzetti, Gabilan & Gananca (2009), which were completed several years later. Dorigueto et al. (2009) conducted a longitudinal study where they followed one hundred patients for one year after a canalith-repositioning maneuver (Figure 4) was performed to treat their symptoms of BPPV. The purpose of this study was to determine the recurrence and persistence of BPPV post treatment. Dorigueto et al. (2009) found that 96% of those treated did not have symptoms of BPPV immediately following canalith-repositioning maneuver. During that year only 26% of the subjects had recurring BPPV and 4% had persistent BPPV. For the 4% of patients that had persistent BPPV a treatment called Aquatic Physiotherapy for Vestibular Rehabilitation (APVR) was administered during the year. It was found that the use of APVR treatment in persistent BPPV subjects lead to a higher quality of life and less symptoms of BPPV. Dorigueto et al. (2009) revealed that though 96% of patients with BPPV can have relief immediately following canalith repositioning, it is possible that BPPV will reoccur later. This study differs from other studies on BPPV such as Gans and Crandell (2000) because it is a longitudinal study that suggests that patients may need to have the canalith-repositioning maneuver repeated multiple times. This study did have similar findings as

Gans and Crandell (2000) in that they determined that the average patient requires 1.3 sessions for canalith repositioning to be effective. Gans and Harrington-Gans (2002) used data collected from 376 patients who had been treated for BPPV with either the Canalith Repositioning Maneuver or the Semont Liberatory Maneuver. The research indicated that both methods had a high success rate after one treatment. The research also indicated that the Semont Liberatory Maneuver treatment when used resulted in a reduced recurrence rate of BPPV over 30 days when compared to Canalith repositioning Maneuver. This indicates that performing the Semont Liberatory Maneuver will reduce the recurrence rate of BPPV. Salvinelli et al. (2003) completed a study utilizing Semont's Liberatory Maneuver in one group of patients with BPPV and no treatment in a separate group of people diagnosed with BPPV. Salvinelli et al. (2003) also found that Semont's Liberatory Maneuver improved the patients' activity of daily living compared with the non-treatment group. This study indicates that the Semont's Liberatory Maneuver resulted in 87% of the patients having no recurrence of symptoms after a six-month follow up. Kulcu, Yanik, Boynukalin, and Kurtais (2008) created a study where they split patients who had BPPV into two groups. One group was taught how to complete Cawthorne-Cooksey exercises six times daily for 4 weeks. Cawthorne-Cooksey exercises are exercises that consist of head and eye movements. The second group was prescribed 8 mg/d of betahistine three times a day for four weeks. Kulcu et al. (2008) indicated that betahistine is medication that has been used for symptoms of vertigo for patients who have Menier's disease and BPPV in clinical studies. The Vertigo, Dizziness, Imbalance Questionnaire (VDI) and the Vertigo Symptom Scale (VSS) were administered to subjects to determine the severity of their symptoms of vertigo throughout the eight-week study. It was discovered that those patients on betahistine showed an improvement in their dizziness after only two weeks while those who used the Cawthorne-Cooksey exercises did not show improvement until the fourth week of the study. Both the exercises and medication were discontinued after four weeks. Results indicated that people who were in the exercise group continued to improve while those in the betahistine group returned to baseline scores. This indicates that exercises are more effective than medication and should be utilized instead of medication. As discussed by Kulcu et al. (2008) betahistine does not address the underlying cause of the symptoms of BPPV, has many negative side effects that can reduce quality of life, and is only effective while in use. For these reasons the authors believe that exercises such as the Cawthorne-Cooksey exercises should be taught to patients to help alleviate the effects of dizziness caused by BPPV.

In the case of horizontal canal involvement, the barbeque roll technique, Gufoni maneuver, or the Appiani Liberatory may be used. Gans and Gans (2002) briefly discussed both maneuvers reporting that the Appiani Liberatory technique is completed by doing the side lying liberatory movements with an additional downward head turn while in the lateral body position. Gans and Gans (2002) discussed that the Appiani Liberatory technique may be easier for people who are overweight or elderly. The barbeque roll technique according to Gans and Gans (2002) involves the patient lying on a table and rolling in 90-degree intervals until the oticonia is cleared. In both of these treatments it should be noted that the beginning position starts away from the affected ear, which is different than both the canalith repositioning and Semont Liberatory Maneuvers (Gans & Gans, 2002). The Gufoni maneuver is also reported to be similar to the Semont Maneuver and was created due to difficulty older patients and overweight patients had when attempting to complete the barbecue maneuver (Gufoni, Mastrosimone, & Di Nasso, 1998). To administer the Gufoni maneuver the Dix-Hallpike is performed and after the patient's initial nystagmus has disappeared, the patient's head is moved two steps of 90 degrees each (Gufoni et al., 1998; Magliulo et al., 2005). Once the patient's nystagmus has stopped in each step the patient is then seated upright (Magliulo et al., 2005). Magliulo et al. (2005) report that the Gufoni maneuver has been found to be effective 80-100% of the time with a recurrence of symptoms between 5-20%.

Several studies have not only researched methods to treat BPPV but also methods to reduce it from reoccurring. Helminski, Janssen, Kotaspouikis, Kovacs, Sheldon, McQueen, and Hain (2005) completed a two-year longitudinal study to determine if there was a significant difference in the recurrence rate of BPPV in patients who completed the Brandt-Daroff exercises daily and those who did not. One hundred and sixteen patients who had BPPV were followed, forty-three patients were in the treatment group that completed Brandt-Daroff exercises daily while the remaining seventy-three were in the non-treatment group. After the two years Helminski et al. (2005) research indicated that there was no significant benefit from those subjects who completed the Brandt-Daroff exercises daily in the recurrence of BPPV. These findings contradicted a previous study by Amin et al. (1999) who used a similar sample size but found that the Brandt-Daroff exercises have a significant benefit for subjects who used them. Helminski et al. (2005) research indicated that the home canalith repositioning procedure is more effective than the Brandt-Daroff daily exercises.

The duration of postural restrictions after the treatment of BPPV have been discussed through out the literature. McGinnis, Nebbia, Saez, and Rudolph (2009) wrote a retrospective study discussing the outcomes for patients who had postural restrictions for 24 hours compared to those who had restrictions for 48 hours. This comparison was completed on a sample of 76 subjects, sixty-six received 24-hour post treatment restrictions while ten received 48-hour post treatment restrictions. The results of this study indicated that both post treatment restrictions resulted in positive outcomes. It was concluded that having patients follow only 24-hour restrictions was as effective as those who followed 48-hour restrictions (McGinnis et al., 2009). These findings indicate that the use of 24-hour post treatment restrictions can be used on patients after canalith repositioning. It was discussed that by reducing the amount of time patients are restricted will not only increase the conformity of patients to their post treatment instructions but also allow for patients to return to their activities of daily living faster than 48 hour post treatment restrictions (McGinnis et al., 2009). A study completed by Moon, Bae, Kim, Kim, and Cho (2005) also researched the effects of postural restrictions after BPPV treatment. In their study, Moon et al. (2005), gave restrictions to one group to sleep sitting up for two days and avoid laying on their effected side for one week after the treatment, and no restrictions for the other group. It was found that postural restrictions after BPPV treatment had no effect on the success of the treatment (Moon et al., 2005). Moon et al. (2005) study indicates that there is no need for postural restrictions, which differs from McGinnis et al. (2009) who suggest the need for 24 hours of restrictions. Roberts, Gans, DeBoodt, and Lister (2005) discovered similar results compared with Moon et al. (2005). Roberts et al. (2005) used a control group that had no restrictions and a group that was given post-maneuver restrictions. Roberts et al. (2005) found no difference between the two groups outcomes, indicating no need for postural restrictions after repositioning maneuver. Casqueiro, Alejandra, and Gerardo (2008) performed a study to determine if postural restrictions were needed after treatment of BPPV with repositioning maneuvers. This study also used a control group that did not have to fulfill restrictions and a group that had postural restrictions. As with Roberts et al. (2005) and Moon et al. (2005), Casqueiro et al. (2008) found no difference between the reoccurrence of BPPV between the two groups, solidifying the fact that there is no difference between outcomes of those who are given restrictions post treatment and those who are not. Due to these current results it seems that the need for postural restrictions is void and patients should begin to live their lives normally after they have received treatment.

CHAPTER 4

Conclusion

It is within an audiologist's scope of practice to identify hearing loss as well as identify issues arising from disorders within the vestibular system. A common problem associated with the cochlea that is addressed by an audiologist is sensorineural hearing loss, while the most commonly addressed cause of vertigo is BPPV (Wiley et al., 2000; Horn, 2009; Froehling et al., 1991; Schuknecht, 1969). As discussed, both disorders have been found to negatively impact quality of life.

One responsibility of an audiologist is to determine what pathology is causing a patient problems and how it is affecting their quality of life. Thus, after the cause of the problem has been determined it is within an audiologist's scope of practice to attempt to improve the patient's quality of life. With any medical practice it is important to utilize researched based practices to ensure patients will truly benefit from procedures and treatments. Hearing aids are one of the most common treatments for hearing loss and often thought to be an expensive resolution. For this reason this author was interested in determining if there was a sufficient amount of evidence to indicate that hearing aids do in fact improve a person's quality of life. Through a broad literature review this author concludes that hearing loss does negatively impact a person's quality of life and through the consistent use of hearing aids, quality of life can be significantly improved. Further, it was found that hearing loss negatively impacts the spouse and family of the hearing-impaired and when hearing aids were consistently utilized the questionnaire results also indicated that spouse's quality of life significantly improved. These results show that hearing aids are an appropriate tool in order to improve their quality of life. These results also indicate that questionnaires regarding a patient's hearing loss should be given before and after hearing aid fittings to ensure that hearing aids are improving the patient's quality of life.

As mentioned, BPPV is the most common cause of dizziness in older adults and often goes undiagnosed for long periods of time. Research has indicated that people with BPPV experience negative impacts on their quality of life. Often people who have BPPV have been paying excessive amounts of money to many different professionals to determine the cause of dizziness, only to be continually referred to yet another expensive professional (Horn, 2009). It is an audiologists' responsibility to identify and treat BPPV as well as let other professionals know where to appropriately refer patients who present with vestibular disorders. Through an extensive literature review of BPPV, this author concludes that BPPV has a negative impact on a person's quality of life. The literature indicates that there are several repositioning maneuvers that can be utilized when treating BPPV that are shown to cure the symptoms of BPPV. This literature review also indicates that anti-dizziness drugs, daily exercises, and post treatment restrictions do not significantly affect the overall outcomes when treating BPPV.

Hearing loss and BPPV are disorders of the ear and within an audiologist's scope of practice. Both disorders result in a reduced quality of life for those effected as well as their family members. Fortunately, both disorders have several options of treatment that have been shown to significantly improve quality of life.

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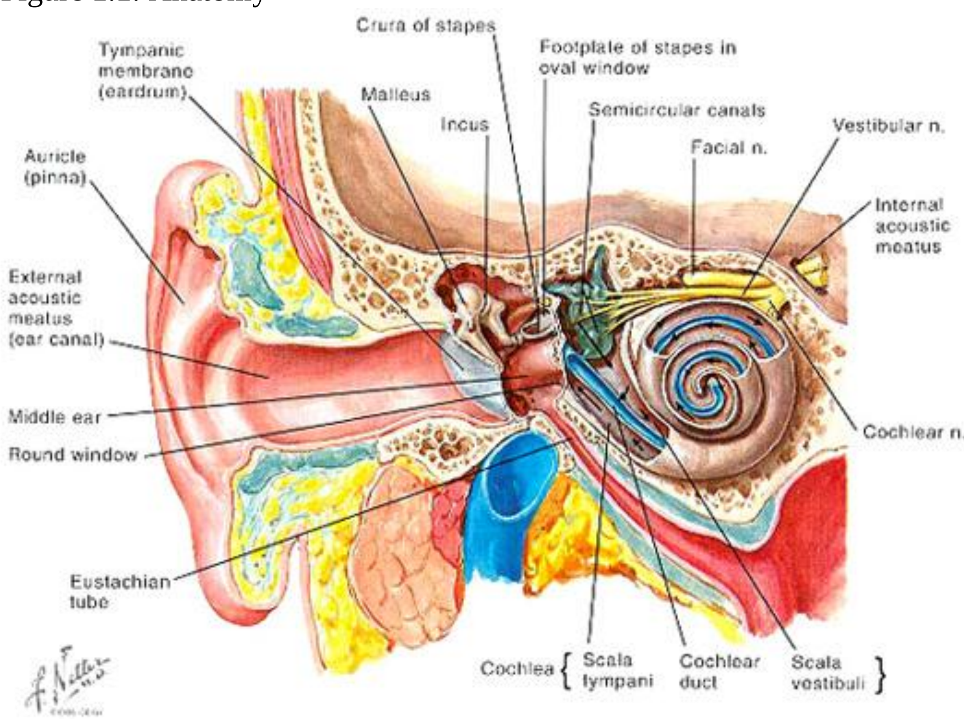
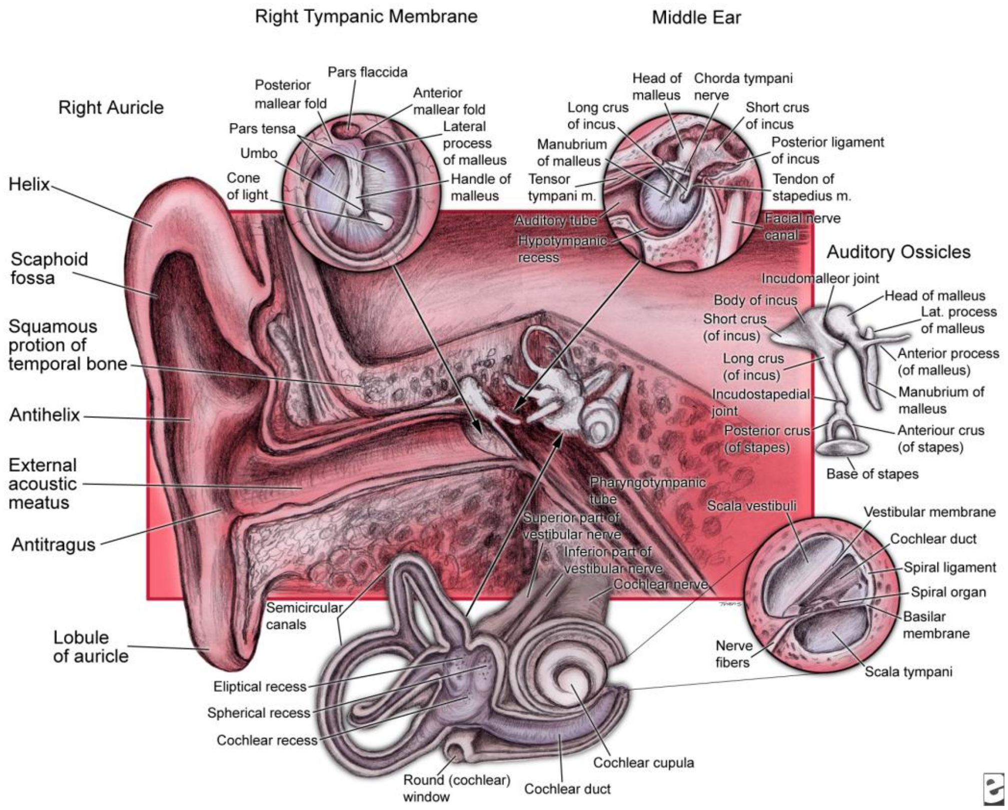
APPENDIX 1 (ETC IF NECESSARY)

Figure 1.1: Anatomy



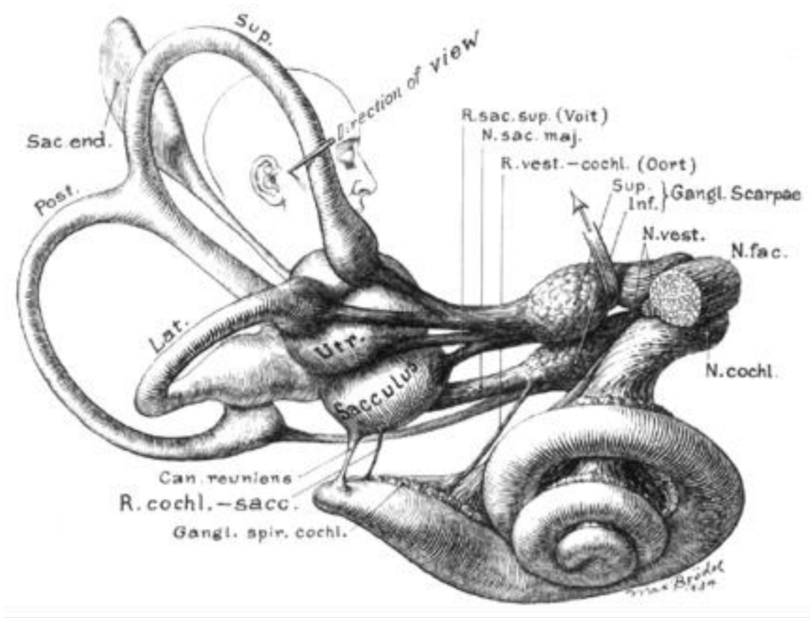
(http://skepticdetective.wordpress.com/2009/04/)

Figure 1.2: Anatomy of the Ear



(Tewfik, 2009)

Figure 1.3: Vestibular System Anatomy



(http://ptjournal.apta.org/cgi/content/full/84/4/373/F1)

Figure 1.4: Canalith Repositioning Maneuver
Roberts et al (2005)

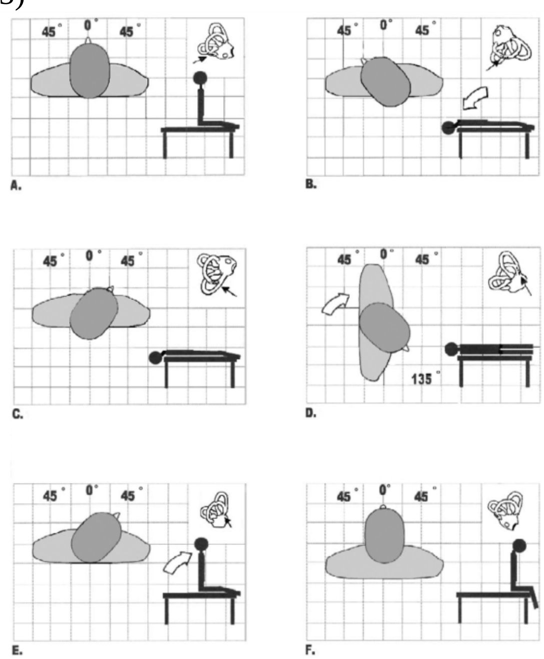


Figure 1. Canalith repositioning maneuver positioning sequence is shown for hypothetical left posterior canal benign paroxysmal positional vertigo. (*A*) Patient is in primary position seated and facing forward. (*B*) Position 1: Body reclined and head placed over end of table, extended, and rotated 45° to left. Otolith debris moves to center of posterior canal. (*C*) Position 2: Head rotated 90° to right (45° right of center) and kept well extended. Otolith debris moves to common crus. (*D*) Position 3: Head and body rotated 90° to right onto right shoulder (head 135° right of supine). Otolith debris traverses common crus. (*E*) Patient is returned to primary position. Body brought to seated position with head maintained at 45° right of center. Otolith debris enters utricle. (*F*) Head turned forward to center position with chin down at about 20°. (Adapted with permission from Gans, 1996.)